Nokia Customer Care
6235/6235i/6236i (RM-60)
Mobile Terminals

Antenna Description and Troubleshooting

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Contents Page

Introduction 3
Visual Quality Requirements 3
Failures and Corrective Measures 3
Antenna Position 3
Internal Antenna 3
Damaged RF Feed, Ground Pins, or IHF Speaker Pins 4
Damaged GPS antenna, pins, or heat stake 5
Obstructed IHF Speaker, RF Feed, and Ground Pads 6
CDMA OR GPS RF Connector Failure 7
Grounding of Display Frame 8
Testing the CDMA Antenna 8
Calibration Factors 8
Calibration Factor for PCS1900 Frequency 9
Measurement Procedure for Cell800/PCS1900 Mobile Terminals 9
Testing GPS Antenna 9
Calibration Factor for GPS 9
Measurement Procedure for GPS Antenna 10

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Introduction

The mobile terminal incorporates an internal antenna. This antenna arrangement is used for AMPS/CELL and PCS frequency bands. The internal antenna assembly consists of a Planar Inverted-F Antenna (PIFA) used for the cellular engine and an Inverted-F antenna (IFA) used for the GPS engine, which is placed on the side of internal antenna body.

Visual Quality Requirements

Following are the minimum acceptable visual quality requirements of the internal antenna assembly:

- Gloves must be used when handling antennas. Do not touch the antenna radiator with bare hands.
- No visual cracks or mechanical defects.
- No oil, dirt, or particles are present on the parts.
- Radiator must be aligned with the plastic housing.
- GPS antenna contacts must be inside the plastic housing.
- Radiator must be flat with no warping.
- All pins must be at the same level.

Failures and Corrective Measures

Antenna Position

The internal antenna is assembled into the B-cover as shown in Figure 1. If no internal antenna is installed, the antenna gain will be degraded by more than 25 dB.

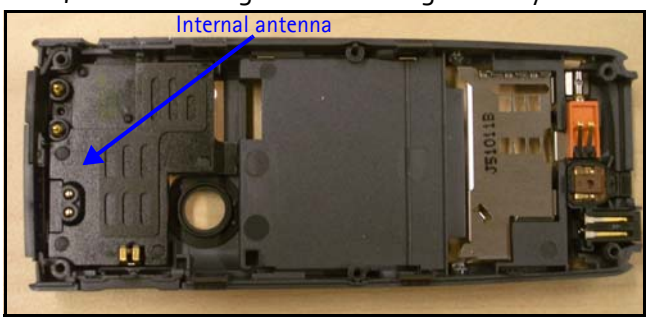

Figure 1: B-cover assembly

If the internal antenna is missing, install one. If the radiator looks obviously damaged, then replace the internal antenna.

Internal Antenna

The internal antenna includes a planar-inverted F antenna (PIFA) radiator and an inverted F antenna (IFA), which is the GPS antenna radiator, attached to a plastic carrier.

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An integrated hands-free (IHF) mini speaker is integrated inside the plastic.

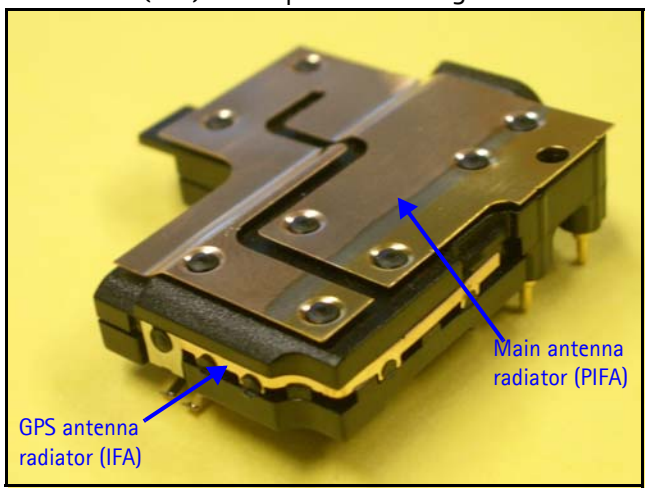

Figure 2: Internal antenna

Note: The GPS antenna is only functional on models that support the GPS engine.

Damaged RF Feed, Ground Pins, or IHF Speaker Pins

The main antenna and the GPS antenna have pins (spring clips) that must properly touch the PWB. Positioning of these pogo pins is shown in Figure 3. Two pogo pins are inserted in the black plastic module.

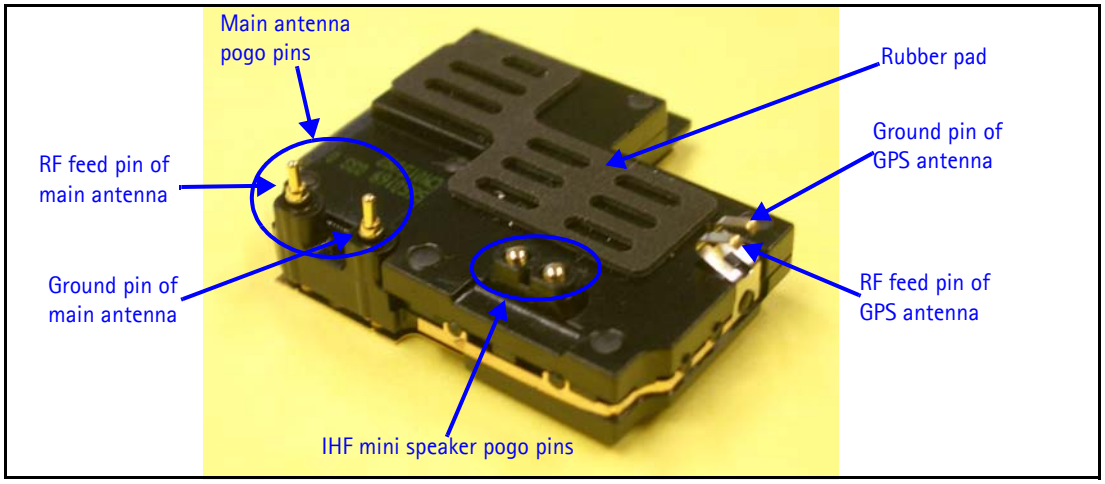

Figure 3: Back view (internal antenna)

- One end of the pogo pin touches the antenna; the other end touches the pad on the PWB. If either of them is missing or damaged (i.e. get stuck in the black plastic module or loses the inside spring force), the antenna will lose contact to the PWB. Then the antenna module must be replaced with a good one.
- If the main antenna's RF feed pin does not touch the PWB, the antenna gain degrades by more than 25 dB and the GPS antenna is detuned.
- If the ground pin of the main antenna does not touch the PWB, the antenna gain degrades about 5 to 10 dB and the GPS antenna is detuned.
- If the GPS antenna's RF feed pin does not touch the PWB, then the GPS antenna gain degrades by more than 20 dB.

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- If the ground pin of the GPS antenna does not touch the PWB, the GPS antenna gain may degrade by more than 5 dB.
- If either the RF feed pin or ground pin are broken or bent such that either pin does not touch the PWB, then replace the internal antenna.
- If either the RF pin or ground pin springs appear damaged, then replace the internal antenna.
- If either of the IHF speaker pins is damaged or missing, the speaker will not connect to PWB. Then the antenna module must be replaced with the correct one.
- If the rubber pad on the antenna module is missing, then replace the antenna module with a properly assembled antenna module.

Damaged GPS antenna, pins, or heat stake

The GPS antenna is heat staked to the plastic.

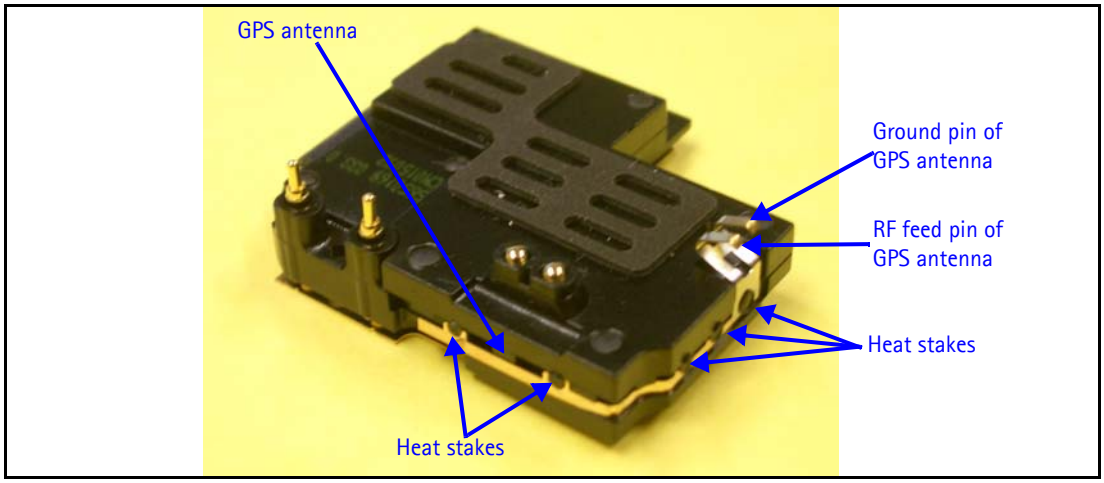

Figure 4: Back view (GPS antenna)

If any of the following problems happen, the antenna should be replaced with a correct on GPS antenna is missing.

- GPS antenna looks obviously damaged.
- Any of the 5 heat stakes look damaged, the GPS antenna will be loose.
- Any of the 5 heat stakes are over heated and melt GPS antenna into plastic, antenna will look distorted and bent.
- Either of the GPS antenna feed or ground leg is broken, or bent such that either pin will not touch the PWB.

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Obstructed IHF Speaker, RF Feed, and Ground Pads

The antenna module connects to the PWB at specific places. These are show in Figure 5.

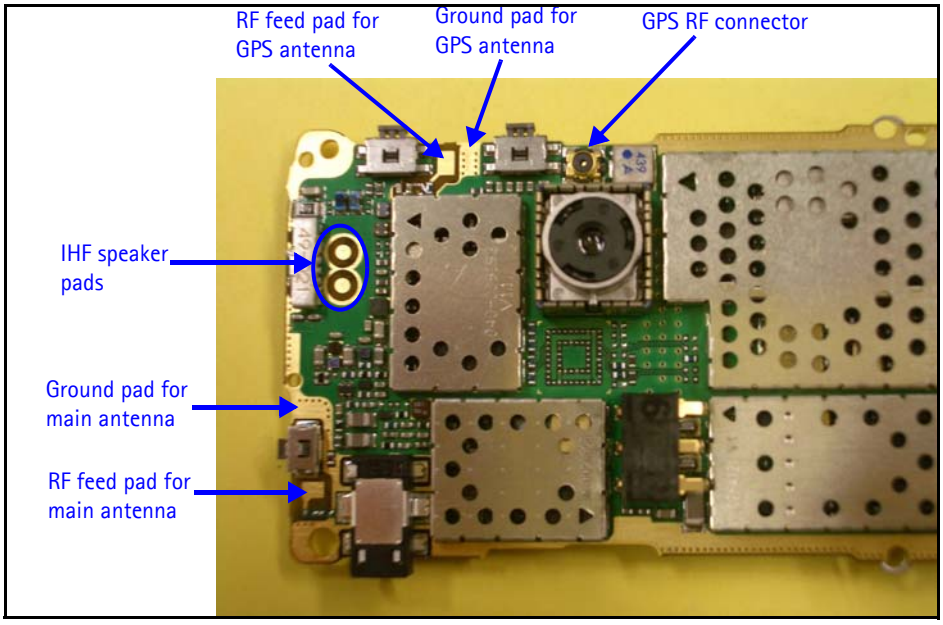
RF feed pad for GPS antenna
Ground pad for GPS antenna
GPS RF connector
IHF speaker pads
Ground pad for main antenna
RF feed pad for main antenna

Figure 5: PWB layout of IHF speaker, RF feed, and ground pads

Check the following problems:

- If the main antenna feed pad is obstructed, removed or covered, then the internal antenna feed pogo pin will not touch the PWB and the antenna gain will degrade by more than 25 dB.
- If the main antenna ground pad is obstructed, removed or covered, then the ground pogo pin will not touch the PWB and the antenna gain will degrade more than 5 dB.
- If corrosion is present or the pads are missing, then the PWB and phone needs to be replaced.
- If either pad is obstructed or covered, the pads should be cleared and cleaned.
- If the GPS antenna feed pad is obstructed, removed or covered, then the GPS antenna feed leg will not touch the PWB.
- If the ground pad is obstructed, removed or covered, then the ground spring clip will not touch the PWB.
- If the IHF (Internal Hands Free) speaker pads are obstructed, removed or covered then the IHF speaker will not produce sound.
- If corrosion is present or the pads are missing, then the PWB and phone needs to be replaced.
- If either IHF speaker pad is obstructed or covered, the pad should be cleared and cleaned.

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CDMA OR GPS RF Connector Failure

CDMA and GPS use the same type of RF connector. The RF connector fails when it does not connect the RF input to the RF output.

- If this happens to the CDMA RF connector, then the antenna gain will degrade by about 25 dB.
- If this happens to GPS RF connector, the GPS antenna gain will degrade by about 20 dB.

The RF connector can be checked by testing for DC conductivity between the RF input and RF output. The DC conductivity test must be done without any cable attached to the RF connector. Since the RF connector is also a switch, the RF output will be disconnected from the RF input when a cable is inserted into the RF connector. When a cable is not inserted, the RF input is connected to the RF output of RF connector. The locations of the both RF connectors are shown in Figure 5 on page 6.

- **CDMA RF input** - connects to duplexer
- **CDMA RF output** - connects to antenna pad through vias
- **GPS RF input** - connects to GPS ceramic filter output
- **GPS RF output** - connects to GPS antenna matching circuits
- **RF connector** - connects to coaxial cable

If the RF input is not connected properly to the RF output, then the RF connector must be replaced.

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Grounding of Display Frame

The display frame is grounded to the PWB through two ground panels. The display frame grounding impacts the radiation performance of the mobile terminal.

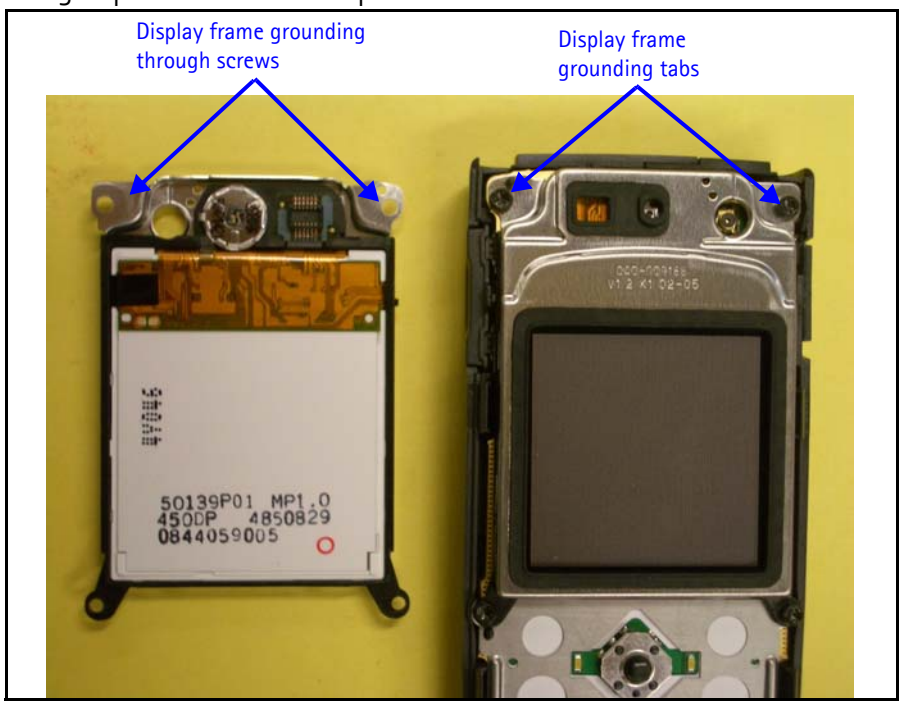

Figure 6: Display assembly ground points

Check for the following problems:

- If the clips are not touching the PWB, or are corroded, obstructed, then the display frame should be replaced.
- If the screws are loose then tighten them.
- If the screws are missing, install new ones. Figure 6 shows the contact between the display frame ground clips and the PWB in greater detail.
- If any portion of the metal display frame is damaged, or if the metal display frame is not properly attached to the rest of the display assembly, then this display assembly must be replaced with a good one.

Testing the CDMA Antenna

Calibration Factors

Define the AMS RF coupler CPL-8 calibration numbers using the test adapter DA-54. Obtain the calibration numbers by utilizing a mobile terminal with known RF and antenna performance. Each test adapter should only require a single calibration on PCS1900 and GPS bands at used test frequencies. Additional calibrations should only be needed if the test adapter is substantially modified (reassembled, changed parts, dropped, etc.).

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Calibration Factor for PCS1900 Frequency

Use a call box to turn on the transmitter of the mobile terminal with a known output power and antenna performance at the maximum output power (all bits up). Measure the transmitted power on the RF connector and through a coupler at CDMA PCS channel 1175. Use the difference between the transmitted and received powers as the calibration number (path loss on Cell band including coupler, cable, and attenuator path losses) for the coupler on Cell band.

The nominal value for power measured at the RF connector is 23 dBm. The coupler path loss is normally ~17...18 dB at the PCS band. If a 10 dB attenuator and a cable with ~1 dB loss is used, the total path loss is 28 to 29 dB and the measured power should be from -5 to -6 dBm [23 dBm - (28...29 dB)]. However, path loss has to be measured separately for every coupler because path losses vary depending on the setup, cables, and attenuator.

Measurement Procedure for Cell800/PCS1900 Mobile Terminals

1. Place the mobile terminal with the display up in the test adapter (DA-54).
2. Turn on the mobile terminal's transmitter at the PCS band on CDMA mode channel 1175 at maximum output power (nominal 23 dBm at RF connector).
3. Measure the RF power with a CPL-8 coupler. This represents the internal antenna to RF coupler measurement.
4. Turn the mobile terminal's transmitter off.

The CDMA antenna test fails if the measured power is outside the test limits.

Table 1: CDMA Measurement Test Limits

Min Measured Power + Coupler, Cable and Attenuator Path Loss	Nominal	Max Measured Power + Coupler, Cable and Attenuator Path Loss
20,0 dBm	23 dBm	26,0 dBm

Testing GPS Antenna

Calibration Factor for GPS

In GPS test mode 3, the GPS receiver is fed with a CW signal. The GPS receiver should report C/No ratio of 35 dBHz with a -110 dBm signal level on the RF connector (-110 dBm + cable loss) at signal generator output. The reported C/No figure is recorded with the signal fed to the RF connector. The C/No value is read with a coupler engaged. Increase the GPS signal level until the same C/No value is recorded. Use the difference between the CW signal levels at the generator as the calibration number (path loss on GPS band including coupler, cable, and attenuator losses).

The nominal coupler path loss at GPS band is 14 to 17 dB. If you use a 10 dB attenuator and cable with 1 dB loss, the total path loss is 25 to 28 dB. The signal level at generator output must be -85 to -82 dBm [-110 dBm -(-25 dB to -28 dB)]. However, the path loss

has to be measured separately for every coupler because the path losses vary depending on the setup, cables, and attenuator.

Measurement Procedure for GPS Antenna

1. Place the mobile terminal in the test adapter (DA-54) with the display up.
2. Turn on the CW signal generator [with power -110 dBm + coupler, cable, and attenuator path loss at GPS band] fed to the RF coupler.
3. Read the reported C/No figure with the test mode 3 three to four times to see if it is stable.

The GPS antenna test fails if the C/No value is outside the test limits.

Table 2: GPS Antenna Measurement Test Limits

Min	Nominal	Max
31,0 dBHz	35,0 dBHz	38,5 dBHz

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